1964 REPORT ON

Turfgrass Research

Report 225

Turfgrass Research Committee
Agricultural Experiment Station
The University of Arizona
Tucson

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1964 REPORT ON TURFGRASS RESEARCH

TURFGRASS RESEARCH COMMITTEE

AGRICULTURAL EXPERIMENT STATION

THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

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1964 Contributors to the Turfgrass

Research Committee Program

Geigy Chemical Corporation

The Upjohn Company

Magelsdorf Seed Company

Trans-Mississippi Golf Association

Morton Chemical Company

Balfour-Guthrie and Company

Fannin's Service and Supply

Phoenix Lawn and Garden Supply

FERTILIZATION OF TWO VARIETIES OF BERMUDAGRASS

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Department of Agricultural Chemistry and Soils

This study of nitrogen fertilization of Common and Tifgreen bermudagrass, which was discussed in Report on Turfgrass Research 212 (1962) and 219 (1963), was terminated in 1964. The main objective of this study was to compare the effectiveness of various nitrogen carriers for the two varieties. Management of the plots was the same as in 1963 except the plots were burned during the winter to remove thatch.

The same fertilizers (Table 1) and rate (2 lb. N per 1,000 square feet) were used as in 1963. The plots were fertilized April 9 and June 2. Measurements made during the season were density, (using the densitometer described in previous reports), grass yield, and total nitrogen and nitrate content of the grass. Plugs were taken with a West Point turfgrass plugger from Common plots in order to measure top and root growth and thatch formation. Plugs were washed to remove soil, dried, and weighed.

Grass was clipped from an area of 18 square feet of each plot on July 19. The previous weekly mowing was omitted. The grass was collected, dried, and weighed. The samples were analyzed for total nitrogen (Kjeldahl method) and nitrate. Results of all determinations are shown in Table 1.

Results and Discussion

All materials used in this study gave satisfactory results during the 1964 season. Plots treated with Milorganite appeared the best while growth produced by the other materials was quite similar. The untreated check plots were severely deficient in nitrogen throughout the season. Milorganite produced the greatest growth six weeks after fertilizer application, especially with Common, while other materials gave faster response and needed repeating more often. Densitometer measurements did not show differences when taken more than 30 days after fertilization. For both varieties the check gave the lowest density reading of all treatments and there was no difference between the fertilized plots. As shown in previous reports, greater differences have been found among treatments when measured shortly after fertilization. Plug weights were highly variable and did not show any relation to treatment. All fertilizers produced grass with higher total nitrogen than the untreated check, but differences between materials were not significant. Tifgreen contained more total nitrogen than Common. Nitrate contents were low for all treatments and differences were not significant.

One reason for terminating this study was because of invasion of Common plots by the Tifgreen. Under the management used which included close mowing at weekly intervals the Tifgreen spread quite rapidly into the Common plots.

These studies have shown that the two varieties have similar nitrogen needs. One to two pounds of nitrogen per 1,000 square feet at four to six week intervals produced satisfactory results for both varieties.

Table 1. Effect of various nitrogen fertilizers on certain factors associated with turfgrass quality.

	COMMON						TIFGREEN				
TREATMENT	DENSITY[1]		CLIPPING[2]	PLUG[3]	TOTAL[4]	NO_3-N[4]	DENSITY[1]		CLIPPING[2]	TOTAL[4]	NO_3-N[4]
	July 8	Aug. 27	WEIGHT	WEIGHT	N		July 8	Aug. 27	WEIGHT	N	
			gm	gm	%	ppm			gm	%	ppm
Check	44.8	47.6	19.2	2.5	1.73	225	44.0	47.4	12.2	1.92	150
Ammonium Nitrate	46.3	49.5	71.8	3.7	2.31	181	47.0	49.1	54.8	2.54	216
Ammonium Sulfate	47.0	48.3	57.2	3.2	1.98	239	47.3	48.0	84.9	2.29	158
N-Serve	45.5	49.0	69.4	3.0	2.20	171	46.0	48.6	72.0	2.44	158
Urea	46.1	49.1	76.9	2.9	2.32	181	46.3	49.0	67.6	2.39	185
Urea-Sulfur	46.5	47.8	62.5	3.0	2.33	181	47.6	48.9	75.1	2.64	246
Aqua Humus	46.1	48.3	58.5	2.5	2.43	127	46.9	48.9	68.9	2.42	202
Milorganite	46.3	48.8	102.2	3.4	2.19	127	46.6	49.4	84.1	2.74	175

[1]Average of two readings per plot with four replicates of each treatment.

[2]Average of four replicates, from an area of 18 square feet, harvested July 19.

[3]Average of six plugs per plot with four replicates of each treatment, sampled July 24.

[4]Determinations on clippings of July 19.

SPRINKLER VERSUS SUB-SURFACE IRRIGATION OF BERMUDA GRASS....YEAR II

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Introduction:

The comparison of sprinkler and sub-surface irrigation was designed to evaluate bermuda grass response with respect to:

a. The amount of water used.
b. The quality of turf produced.

The initial year's data was summarized in Agricultural Experiment Station Report No. 219, titled '1963 Report on Turf Grass Research,' as follows: "The first year's results indicate little noticeable difference in either the quantity of water required or the quality of turf produced by the two irrigation systems."

1964 Observations:

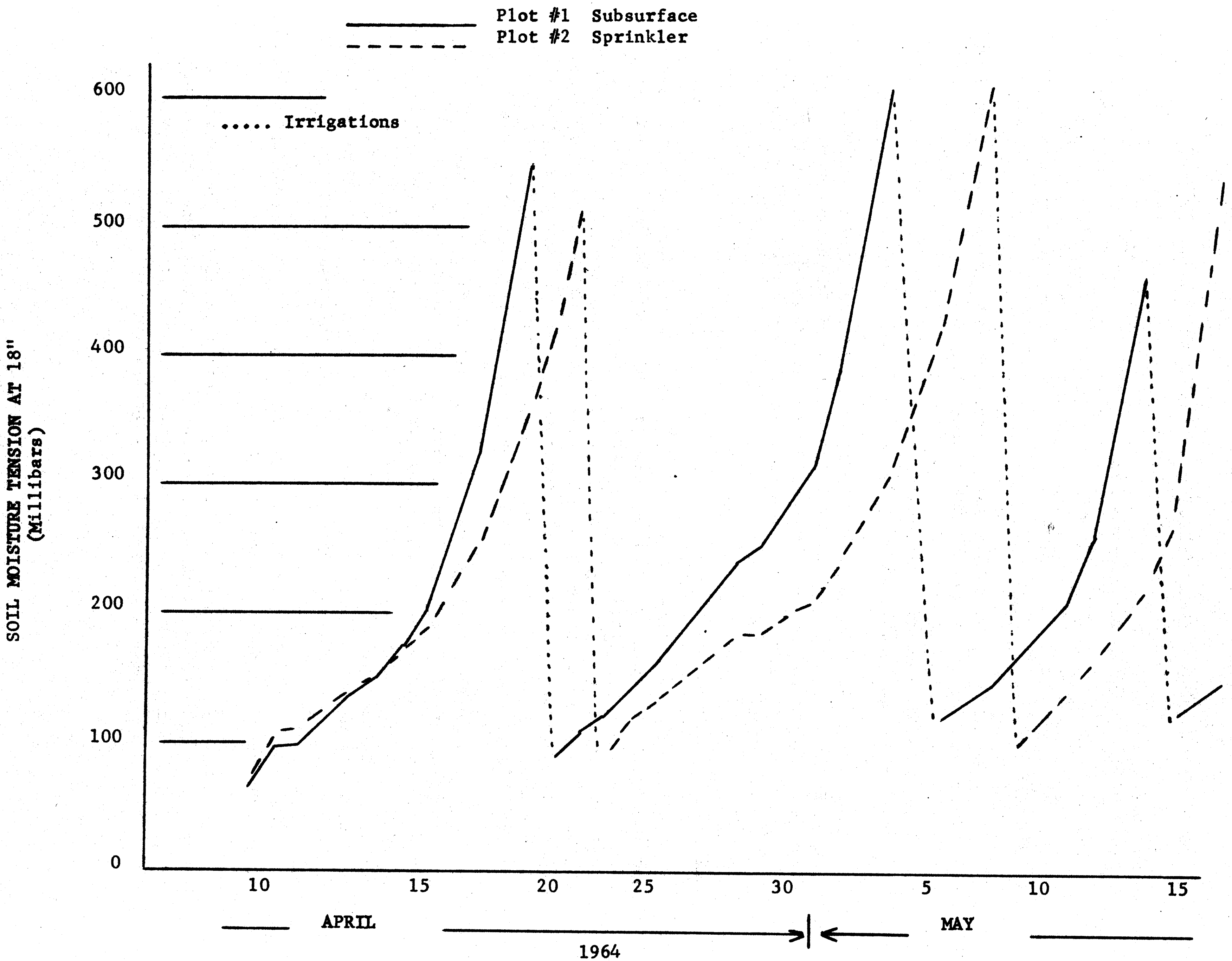
The irrigation season was extended to include the data of April, May, and June for the second year of the evaluation. Early in June it was felt that the frequency of irrigation was greater than necessary. Therefore, tensiometer depth was changed from 12" to 18" so that a reading of 500-600 millibars would reflect a greater stress in the plant root zone. This new depth was continued throughout the remainder of the irrigation season with no detrimental effects being observed. Representative tensiometer data for sprinkler and sub-surface irrigation plots is presented as Figure 1.

A degree of leaf yellowing was noted on all plots by mid-May. This was subsequently diagnosed as iron chlorosis. On sprinkler irrigated plots the chlorosis appeared in random areas, whereas on the sub-surface irrigated plots the chlorosis was associated with the placement of the sub-surface irrigation plastic pipe. (Versenol at one tablespoon per two gallons for two hundred square feet.) The addition of iron chelates, through spraying the foliage, completely eliminated the iron chlorosis problem.

The plots were all fertilized early in July with an aqueous application of 2.4 pounds of ammonium nitrate per plot.

Bermuda mite, leaf hopper, and fungus infestations were noted in the plots during this second irrigation season. The various infestations were treated soon after diagnosis. It must be noted, however, that the various infestations appeared independent of the irrigation treatments.

Figure 1 Representative Tensiometer Data



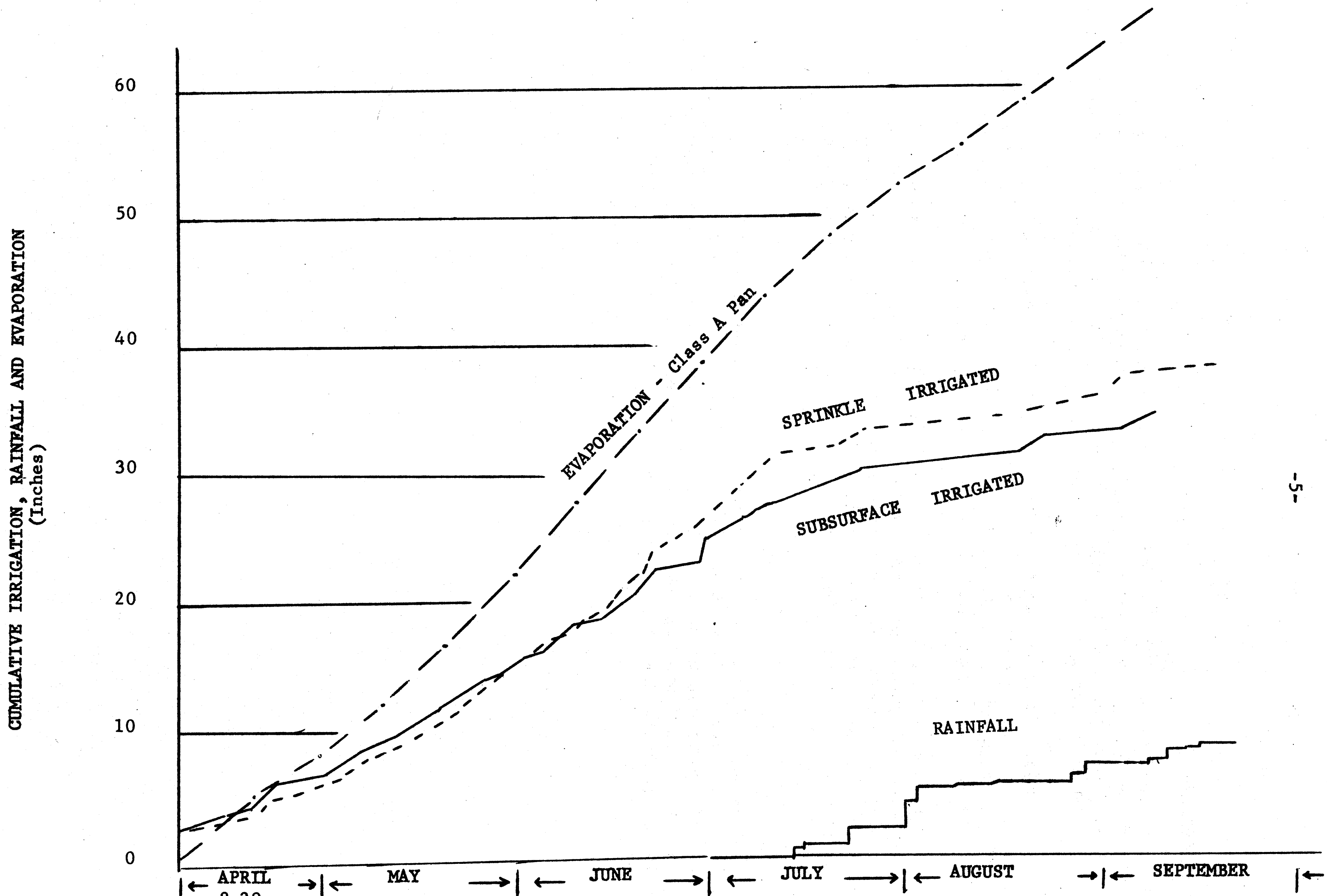


Figure 2 Turfgrass Irrigation Requirements 1964

1964 Results:

Plot response in 1964 was quite similar to that of 1963. Relative growth rates, as indicated by clipping weights taken periodically throughout the season, were not significantly different. Weekly color comparison also failed to show a significant difference for irrigation treatments.

The comparison of cumulative water use for the treatments is given in Figure 4. As can be noted, water use by the two treatments are identical through the first three months of the irrigation season. The noticeable difference for the last three months was not statistically significant.

For reference purposes, Figure 2 includes cumulative evaporation from a class A weather bureau pan and cumulative rainfall for the period covered by the plot irrigation. This comparison served to indicate that total irrigation for the period was not excessive. The growth rate and color observation also served to show that irrigation was adequate for normal growth.

Summary:

The second year of experimentation that compared sprinkler with subsurface irrigation of turf paralleled the first year's results. Specifically, little difference can be noted in either the amount of the water required or the quality of turf produced by the two treatments when irrigation is controlled through the use of soil moisture tension readings.

NOTES FROM THE BERMUDAGRASS IMPROVEMENT PROGRAM, 1964

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The turf plots established by Dr. Baltensperger in 1960 were plowed out in 1964 and a new trial established. The new trial includes 16 entries in 4 replicates of 4-1/2 by 30 foot plots plus an additional group of 14 entries represented only once. All plots were established vegetatively from material grown in flats. The common check and two composites of selections made by Dr. Baltensperger were seeded into flats and the resulting sod used for propagation.

Ratings on general turf quality in the 1964 test based upon texture, vigor, color, disease and mite resistance placed Ormond, Tifgreen, Tifway, and 3 numbered selections as best of the replicated material. All of the vegetative selections were free of mites in 1964. Individual seedlings, Arizona Common and two seed composites varied in reaction and small patches of severe infestation resulted. A moderate infection of <u>Helminthosporium cynodontis</u> following the mites hit the mited plants severely.

In cooperation with Dr. Nigh, nematode numbers and kinds will be evaluated over the life of the new turf planting to determine if varieties of bermudagrass differ in the nematode populations which they will support. All plots were sampled prior to planting and all of the planting material was also checked to provide a baseline from which to measure changes in kind or number during the next several years.

Many of the C. dactylon (tetraploid) entries in the new turf test were also established at Yuma for seed production trials. In the case of the composites only certain of the parents are being evaluated at Yuma, the remainder already dropped because of very poor seed production at Marana compared to the others and relatively poor performance in a progeny trial as turf. Among those being evaluated for seed production are two selections (consistently resistant to the bermudagrass mite) whose progeny have also been resistant to this pest.

An intensive greenhouse program is being initiated to screen seedlings from certified lots of Arizona common bermudagrass for resistance to the Helminthosporium complex and to other hazards such as nematodes, salts, chemicals etc., with the long term plan of assembling material with such desirable characteristics for use in the breeding program. As techniques are developed and seed from selections grown at Yuma become available for screening some very interesting combinations of germ plasm should be made possible for further testing as turf.

Preliminary evaluation of bermudagrass varieties in turf test planted June 1964 at Tucson, Arizona (Casa Grande Highway Farm, Arizona Agricultural Experiment Station)

	Average 4 replicates						
	August 1964		September 1964		November 1964		
Variety	% cover	Color (Blue green, Green, Yellow Green)	% cover	Scalping & disease 1-9 1 least	Density 1-5 1 most	Texture coarse medium fine	Winter color Purple Straw Green
T_2 Composite	99	yg	100	4.5	5.0	C	PS
B181 Composite	99	yg	100	4.8	5.0	C	PS
Common check	99	g	100	4.5	5.0	C	PS
Ormond*	90	bg	100	3.2	1.2	F	S
Tifgreen**	91	g	100	1.2	1.0	F	S
Tifway*	81	g	100	2.2	1.2	MF	GS
Tufcote	95	g	100	3.0	2.8	M	S
Beltsville # 1	99	bg	100	2.2	3.5	MC	S
B145*	97	bg	100	2.0	3.0	M	PS
B142*	86	g	100	1.8	2.2	MF	GS
B163	100	g	100	7.2	2.8	M	GS
B174	95	yg	100	5.0	2.5	F	PGS
B181	90	g	100	1.0	3.0	M	PS
B143	88	yg	100	8.8	2.2	F	S
B184	91	g	100	4.8	1.2	M	S
B148	94	g	100	6.2	2.0	MC	GS

*Most desirable turf August 1964

	One Replicate only						
RC25	95	g	100	5	2	F	S
RC55	60	g	75	3	2	F	GS
RC58	70	bg	100	4	1	F	GS
RC68	70	yg	100	2	2	F	GS
RC102	65	g	100	2	1	F	GS
RC114	60	g	100	2	1	F	GS
RC129	60	g	100	4	1	F	GS
RC134	50	g	100	4	2	M	GS
RC141	90	bg	100	5	1	F	S
RC145	95	yg	100	5	1	F	GS
B415	50	yg	60	1	5	M	GS
B416	40	g	100	5	5	C	S
B129	95	bg	100	2	2	M	GS
III 297-3	100	yg	100	5	4	C	P

EVALUATION OF MATERIALS FOR THE CONTROL OF THE BERMUDAGRASS MITE

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Experiments evaluating the effectiveness of various materials for the control of the bermudagrass mite, Aceria neocynodonis Keifer, were conducted in the field and greenhouse during the spring and summer of 1964 at Tucson, Arizona.

Materials and Methods:

The names of the materials used in this report, concentrations of the formulations provided, and the manufacturers' names are given in Table 1. To simplify the presentation, trade names of most of the materials are used. No endorsement of the named products is intended, nor is criticism implied of similar products which are not mentioned. Sprays were applied with a Hudson tank-type compressed air sprayer with a 5-foot, 4-nozzle boom with Delavan ES6-80° nozzles for the field plots. A single 6508 Tee-jet nozzle was used for treating grass in 2" or 4" plastic pots in the greenhouse. Granular formulations were applied with a Lawn Beauty fertilizer spreader.

All field experiments were designed with the treatments replicated from four to eight times and randomized within blocks. The plots of each field experiment were examined at intervals following treatment and two methods were used to evaluate the effectiveness of the treatments.

The rating of the mite damage in the field was made by observing the grass or feeling it to determine the amount of mite-injured stems present. Plots without any mite-injured stems received a rating of "1" while those with severe injury received a "9". Ratings of "3", "5", and "7" were used as intermediates. Since the disappearance of the mite-injured stems following treatment was affected by a number of factors, such as the rate of grass growth, amount of mowing, and a possible residual action of the toxin of the mite; a second type of evaluation was used in some experiments. Samples of mite-injured grass were collected from each plot and taken to the laboratory where they were examined under the microscope. This was an extremely rigorous sampling method as samples of infested stems were obtained only with difficulty from some plots and may have consisted of almost the total number of mite-injured stems from the entire plot. On the other hand, in check of poor-treatment plots, such a sample was representative of the whole area. Ratings were made on the abundance of the mites on the stems from "1" with no mites to "9" for stems with many mites, with intermediate ratings where applicable. All the field and microscopic ratings were made by the junior author.

The greenhouse experiments were conducted by a technique developed during 1963, in which mite-infested plugs of bermudagrass were transplanted into 4-inch plastic pots and held in a greenhouse for approximately one week. (Butler _et al_. 1963). Prior to their use in an experiment, a mite-injured stem was removed from each plant and examined for mites. If mites were present the plug was used. Approximately half of the potted plugs became mite-free and were discarded. The pots of infested plants were assigned treatments at random and those of each treatment were sprayed together with two passes of the boom of a compressed air sprayer with a 6508 Tee-jet nozzle, delivering approximately one gallon of spray per 200 square feet. The pots were then placed in wooden flats in a random pattern and held in a greenhouse until examination. The greenhouse was not equipped with cooling, but a constant stream of outside air was brought in with a fan.

Results:

Diazinon was found to be the most effective insecticide tested against the bermudagrass mite during 1963, the granular formulations giving slightly better control than spray formulations. It was also found that there was a significant interaction between diazinon and fertilizers in the spring on turf areas where the fertility level was low (Butler _et al_. 1963). Therefore the two experiments set up in early June, 1964, to evaluate the effectiveness of a number of different materials against the bermudagrass mite were both fertilized before insecticides were applied.

In one experiment the whole area was sprayed on June 4 with Ortho-Gro liquid plant food with a hose proportioner sprayer. Ten different materials were applied to individual 100 sq. ft. plots in eight replicates. On June 15, eleven days after treatment, a rating of the mite damage was made and, as indicated in Table 2, none of the treatments had any effect on the mites. The next day infested stems were taken to the laboratory for microscopic rating. In this analysis, only the 2% diazinon granular treatment showed any reduction of the mites. A second field rating a month after the treatments showed only the granular diazinon treated areas without mite damage.

A second experiment with materials applied the next day, on June 5, by the same personnel and equipment also gave disappointing results. The whole area was treated with ammonium nitrate prior to the application of the insecticides. The untreated plots were almost free of mites when ratings were made ten days later. Only the diazinon spray gave evidence of any mite control, as shown in Table 3. There is no apparent explanation of why diazinon spray gave evidence of mite control in this experiment while the same treatment across the street on the previous day was ineffective. The most obvious difference between the two experiments was that liquid fertilizer was used prior to the ineffective diazinon spray and granular ammonium nitrate where diazinon appeared to have some effect.

A third experiment was set up a month later to compare the various formulations of diazinon with different fertilizer treatments. The results are shown in Table 4. There was no significant variation with the diazinon and the fertilizer treatments, at least at that time of the year. Granular

Baygon appeared to give a good reduction of the mites although the spray at 7.5 cc per gallon was ineffective. Another experiment to evaluate the effectiveness of granular materials was set up in late June, with the treatment rates adjusted to give the same relative amount of actual material per square foot of turf area. The results are shown in Table 5. Baygon granular once again gave a good reduction of the mites, as did the diazinon granules. Bromyl was only fair in its effectiveness and Di-Syston had no effect upon the mites.

In August, a fourth field experiment was set up to obtain additional comparisons of Baygon, as both spray and granular formulations with two diazinon formulations. Both the Baygon sprays and granular treatments gave effective reductions of the mites, as shown in Table 6. A formulation of diazinon with a fertilizer was included. Mite control was not significantly different from that of the granular diazinon alone.

To avoid some of the problems associated with the field trials, such as the uneven distribution of mites, natural disappearance of mites, and unfavorable weather, four series of evaluations of treatments were made on plugs of infested grass in the greenhouse during the summer of 1964.

Two experiments were designed to evaluate the effect of granular formulations. Table 7 shows the effects upon the mites of some of these formulations. Baygon and diazinon appeared to be the best treatments. A second experiment evaluated various rates of Baygon as a granular formulation in comparison with different rates of Baygon as a spray. The results in Table 8 indicate that Baygon in both granular and emulsifiable form appeared to be comparable to diazinon granular formulation.

Two experiments evaluated various materials as emulsifiable concentrates or wettable powders. The results of one test are shown in Table 9. Banol, Baygon and diazinon appear to be effective. A second experiment, the results of which are given in Table 10, indicate that Banol at 10 g. per gallon, half the rate of the previous test, was also effective. Zectran and ethion were also effective in this test. These two materials were reported by Butler (1961, 1962) to be promising, but failed to give effective control in the field in June 1964 (Table 2). However, neither did diazinon spray in this test.

Conclusions:

Chemical control of the bermudagrass mite in the spring with insecticides was not effective always. It is not understood why certain treatments are more effective during the summer than during the spring months. Diazinon granular formulations have given the most satisfactory results throughout the growing season. Preliminary tests indicate that Baygon, in either granular or spray form, is a very promising material. Banol, Zectran, and ethion are also promising. A special formulation of diazinon with a fertilizer mixture appeared to be very promising and offers a "one-shot" spring treatment for controlling the mites and promoting grass growth. Further tests are planned for 1965.

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Table 1. Insecticide materials used in 1964 bermudagrass mite tests.

Banol	U-12927, 75% WP	The Upjohn Company
Baygon	Bayer 39007 13.9%, Control J9214 5% granular	Chemagro Corporation
Bromyl	4 lb./gal Em. SN-3-10287-30 10% granular SN-2-10287-30	General Chemical Division
Diazinon	25E, Spectracide 2% granular Spectracide 2% granular plus fertilizer (special formul.)	Geigy Agricultural Chemicals
Dimethoate	Cygon. 267 30.5% 2.67 lbs. Lot 826-112	American Cyanamid Company
Di-Syston	2% granular, "Scope"	Chemagro Corporation
Ethion	4.0 EC Code 1321	Niagara Chemical Division
GS-12968	40% EC	Geigy Agricultural Chemicals
GS-13005	40% EC FL2357, ARS 1440A-64	Geigy Agricultural Chemicals
Kelthane	18.5 EC	Rohm & Haas Company
Meta-Systox R	25% EC, Control H9132	Chemagro Corporation
Morestan	25% WP, 103-K-24	Chemagro Corporation
Soil sulfur		- - -
Zectran	22% EC, 2E, Lot 08053-6	The Dow Chemical Company
******		
ammonium nitrate		
Ortho-Gro liquid plant food	12-6-6	California Chemical Company

Table 2. The effect of treatments on bermudagrass mite damage to bermudagrass and on mite abundance. Randolph Park, Tucson, Arizona. Insecticides applied June 4, 1964 to 8 replicates of 10' x 10' plots at the rate of 1/2 gallon of spray and 1/2 pound of granular per 100 sq. ft. Test area was sprayed with liquid plant food prior to treatments.

1 = no mite injury; 9 = severe mite injury.

1 = no mites present; 9 = many mites present.

Material	Amount per gal.	Field Rating of Mite Damage		Microscopic Rating of Mite Abundance
		June 15	July 6	June 16
Zectran	30 cc.	8.1	8.2	8.2
Ethion	30 cc.	7.1	8.2	7.2
Banol	18.2 g.	7.5	8.4	7.8
Bromyl	10 cc.	7.4	8.0	8.5
GS-13005	15 cc.	7.5	6.6	8.6
GS-12968	15 cc.	8.1	8.6	8.8
Diazinon	15 cc.	8.3	8.2	7.0
Dimethoate	20 cc.	6.5	5.1	8.0
Kelthane	8.1 cc.	8.1	8.6	8.8
Diazinon	2% gran.	7.0	1.5	1.1
Untreated	- - -	6.7	7.4	8.5
Untreated	- - -	7.6	8.1	8.6

Table 3. The effect of treatments on bermudagrass mite damage to bermudagrass and on mite abundance. Randolph Park, Tucson, Arizona. Insecticides applied June 5, 1964 to 4 replicates 10' x 10' plots at the rate of 1/2 gal. spray per 100 sq. ft. Test area was treated with ammonium nitrate prior to treatments.

1 = no mite injury; 9 = severe mite injury.

1 = no mites present; 9 = many mites present.

Material	Amount per gal.	Field Rating of Mite Damage		Microscopic Rating of Mite Abundance
		June 15	July 6	June 17
GS-13005	7.5 cc.	5.5	3.8	8.0
GS-13005	15 cc.	5.2	5.5	8.0
GS-13005	30 cc.	7.0	5.8	8.5
GS-12968	7.5 cc.	5.2	5.5	7.2
GS-12968	15 cc.	6.5	4.5	8.5
GS-12968	30 cc.	5.2	4.8	6.5
Diazinon	15 cc.	3.8	1.5	1.0
Banol	18.2 g.	6.0	5.2	8.0
Banol	36.4 g.	5.0	4.8	8.7
Untreated	- - -	3.0	3.2	8.5

Table 4. The effect of treatments on bermudagrass mite damage to bermudagrass and on mite abundance. Randolph Park, Tucson, Arizona. Insecticides applied July 10, 1964 to 8 replicates of 3' x 3' plots at the rate of 1/2 gal. spray and 1/2 lb. granular per 100 sq. ft.

1 = no mite damage; 9 = severe mite damage

1 = no mites present; 9 = many mites present

Material	Field Rating of Mite Damage on July 17	Microscopic Rating of Mite Abundance July 20-23
Baygon, 5% granular	7.2	1.2
Diazinon (7.5cc/gal) plus Ortho liquid fertilizer	4.4	1.2
Diazinon, 2% granular on fertilizer	5.0	2.0
Diazinon (7.5cc/gal) plus ammonium nitrate	4.9	2.1
Diazinon, 2% granular	6.8	3.2
Morestan 18.1 gms/gal	7.5	6.9
Baygon 7.5 cc/gal	8.1	7.5
Untreated	7.5	6.0

Table 5. The effect of treatments on bermudagrass mite abundance. Tucson, Arizona. Insecticides applied June 24, 1964 to 5 replicates of 2' x 2' plots.

1 = no mites present; 9 = many mites present

Material	Amount per 4 sq. ft.	Microscopic Rating of Mite Abundance on July 2
2% Diazinon	10 g.	1.0
5% Baygon	4 g.	2.6
10% Bromyl	2 g.	4.9
2% Di-Syston	10 g.	8.5
Untreated	- - -	9.0

Table 6. The effect of treatments on bermudagrass mite abundance. Randolph Park, Tucson, Arizona. Insecticides applied August 19, 1964 to 8 replicates of 3' x 3' plots.

1 = no mites present; 9 = many mites present.

Materials	Amount per 9 sq. ft.	Microscopic Rating of Mite Abundance on August 24
2% Diazinon granular	23 g.	1.6
Baygon	20 cc/gal.	2.5
5% Baygon granular	9 g.	2.9
2% Diazinon granular plus fertilizer mixture	23 g.	3.1
Baygon	10 cc/gal.	3.5
Untreated	- - - -	8.1

Table 7. The effect of treatments on bermudagrass mite abundance in greenhouse tests, Tucson, Arizona. Applied on July 29, 1964 with 8 replicates.

1 = no mites present; 9 = many mites present.

Material	Amount per Pot	Microscopic Rating of Mite Abundance on August 3
5% Baygon	1/8 tsp.	1.0
2% Diazinon	1/4 tsp.	1.3
5% Baygon	1/4 tsp.	2.3
2% Diazinon on fertilizer	1/4 tsp.	3.3
5% Baygon	1/2 tsp.	3.7
10% Bromyl	1/4 tsp.	4.3
2% Di-Syston	1/4 tsp.	6.7
Soil sulfur	1/4 tsp.	8.0
Untreated	- - - -	8.3

Table 8. The effect of treatments on bermudagrass mite abundance in greenhouse tests, Tucson, Arizona. Applied on August 12, 1964 with 8 replicates.

1 = no mites present; 9 = many mites present.

Material	Amount	Microscopic Rating of Mite Abundance on August 18
5% Baygon granular	1/8 tsp.	1.0
5% Baygon granular	1/4 tsp.	1.2
5% Baygon granular	1/2 tsp.	1.0
Baygon	10 cc/gal	1.8
Baygon	20 cc/gal	1.0
Baygon	30 cc/gal	1.0
2% Diazinon granular	1/4 tsp.	1.8
Untreated	- - - -	9.0

Table 9. The effect of treatments on bermudagrass mite abundance in greenhouse tests, Tucson, Arizona. Applied on August 6, 1964 with 8 replicates.

1 = no mites present; 9 = many mites present.

Material	Amt. per gal.	Microscopic Rating of Mite Abundance on August 10
Banol	20 g.	1.5
Diazinon	7.5 cc.	1.9
Baygon	30 cc.	2.5
Morestan	2 tsp.	3.8
Meta-Systox R	7.5 cc.	6.5
GS-12968	7.5 cc.	7.2
GS-13005	7.5 cc.	7.2
Untreated	- - -	8.1

Table 10. The effect of treatments on bermudagrass mite abundance in greenhouse tests, Tucson, Arizona. Applied on August 17, 1964 with 8 replicates.

1 = no mites present; 9 = many mites present.

Material	Amount per gallon	Microscopic Rating of Mite Abundance on August 21
Banol	10 g.	1.0
Zectran	15 cc.	1.5
Ethion	15 cc.	1.5
Banol	20 g.	1.6
Diazinon	7.5 cc.	3.0
Kelthane	5.0 cc.	7.0
Bromyl	5.0 cc.	7.4
Dimethoate	10 cc.	8.0
Untreated	- - - -	8.4

RECOVERY OF A RHODESGRASS SCALE PARASITE IN ARIZONA

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Rhodesgrass scale, Antonina graminis (Maskell), has become an increasingly serious pest of turf grass in Arizona in recent years. The biology and control of this scale is discussed by Chada and Wood (1960) but the chemical controls given are not useful for home turf areas due to the high mammalian toxicity of the materials. Preliminary tests reported by Butler (1960) indicated that diazinon and ronnel were effective against the scale in home lawns.

Dusmetia sangwani Rao, a small wingless parasite, was obtained from Texas in the winter of 1960-61 (Dean et al. 1961) and released in several locations in Tucson (Butler 1961). At that time it was questionable whether or not the parasite had become established due to insecticide applications to turf grass areas and the clearing of Johnsongrass from other release sites.

Three collections of Johnsongrass infested with rhodesgrass scales were made on November 22, 1964 and placed in a rearing cabinet. A number of D. sangwani adults emerged from one sample. The sample was not obtained from a release site but approximately 1/4 mile down a drainage-way from a major release area. One of the other samples that did not have the parasite was collected 100 yards from where the parasite was recovered, but not on a drainage from any release area. It is likely that this wingless parasite may be limited in its ability to distribute itself. More sampling is planned and, if additional parasite-infested scales are found, attempts will be made to establish this parasite in other locations during the coming year.

A coccinellid was obtained quite frequently from rhodesgrass scale-infested Johnsongrass in 1961. It was identified as Diomus debilis (Lec.) or D. minutissimus Csy. by E. A. Chapin in 1962. This predator may be of importance in the natural regulation of rhodesgrass scale populations but additional studies are needed to evaluate its importance.

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OVERSEEDING TRIALS

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The standard cool season grass in Arizona and the southern tier of states has been Rye grass. This grass germinates rapidly or is easily established under a variety of temperature and moisture conditions. The fall transition from Bermuda to Rye grass is rather readily accomplished using Maleic Hydrazide as a warm season grass inhibitor without waiting for cool temperatures.

Transition from the cool to warm season turf in the spring is more difficult. Rye grass is vigorous at this time and will linger competing with Bermuda grass at a period where it should establish its vigor for the growing season. When the Rye grass dies it usually is all at once due to temperature and disease leaving a patchy inhibited Bermuda turf.

In the fall of 1962 in a search for a possible substitute a number of replicated plots seeded October 10 with the following grasses.

	Rates	
Kentucky Bluegrass	.4 lb.	.8 lb/100 sq.ft.
Illahee Fescue	.6 "	1.2 " " " "
Chewings Fescue	.6 "	1.2 " " " "
Pennlawn	.6 "	1.2 " " " "
Rye grass	1.5 "	3.0 " " " "

One series of plots was pretreated with Maleic Hydrazide. Weather was favorable all winter for growing and normal irrigation and fertilization practices followed. Clipping weights were taken weekly throughout the winter and spring. Each plot was a satisfactory turf. The fescues formed a particularly tough, tight turf.

Starting May 1, 1963 weekly ratings were made of Bermuda grass reappearance in the plots. All of the Fescues and the Bluegrass the transition was gradual. In the Bluegrass plots the Bermuda establishment was steady with both grasses exhibiting a good color. In all of the Fescue varieties growth stopped by June 8, the grass was a rather pale green or straw color with Bermuda coming in rapidly and also chlorotic. In the Ryegrass growth ceased with dead spots throughout and the Bermuda chlorotic.

On the basis of the above observations a mixture was prepared in conjunction with the Better Turf Institute for the 1963-64 winter overseeding season.

Pennlawn Fescue	29.88%
Chewings Fescue	29.59%
Kentucky Bluegrass	19.63%
Park Bluegrass	9.09%
Highland Bentgrass	9.94%

This mixture was seeded October 1, 1963 at three rates 1/2, 3/4 and 1-1/2 lbs. per 100 sq. feet and Rye grass as a check at the accepted rate of 1-1/2 lbs. for 100 sq. feet.

All of the plots germinated and formed an acceptable turf. An unusually cold winter ensued with the plots remaining green but no mentionable growth. It was impossible to collect yield data. An occasional mowing was necessary to smooth up the plots. Rye grass which usually grows under quite cold conditions did not grow and had a very unsatisfactory color.

With warm weather the middle of March, growth resumed and the spring transition with the mix was much more satisfactory than the Rye grass.

THE USE OF SOIL AERATION PLUGS FROM GOLF GREENS FOR NEMATODE ANALYSIS

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The importance of plant parasitic nematodes in turf management has been emphasized by the studies of Christie, et al. (1954), Golden and Taylor (1956), Good, et al. (1959), Kelsheimer and Overman (1953), Nigh (1963), Perry (1958), Taylor, et al. (1963), and Tarjan and Hart (1955).

In some areas of the United States nematocides or fungicides possessing nematocidal value are annually incorporated into management practices as a precautionary measure against nematode attack. Because of increased costs of such applications, many greens superintendents prefer to have their soil analyzed to determine the species and numbers of nematodes present before treating.

A commercial type soil auger is frequently employed to obtain soil samples for nematode analysis. On golf greens plugs are removed from several locations, usually in spots where management has been a problem. This necessitates filling the holes left by the auger and replacing the turf with plugs from nurseries.

Since most golf greens receive annual or more frequent aeration treatments, the question arose whether or not the plugs removed during this operation could be utilized for nematode analysis. The following gives the procedures used in a study to evaluate the aeration plugs for nematode analysis.

Procedures:

Aeration plugs from each green selected for the study were gathered immediately following removal, amalgamated and mixed in a plastic bag. A representative sample of 100 cc of the intact plugs was measured and placed in a Baermann funnel for nematode extraction. Following 24 hours, 22 cc of water was withdrawn and the nematode species determined and counted with the aid of magnification. For comparison, four plugs were removed by a one-inch soil auger from each of the same greens at four locations and represented the top six inches of soil. These were combined, mixed, and 100 cc of soil removed and analyzed in the same manner as previously described.

Because of the shallow depth of the aeration plugs (1" to 3", depending upon the type of aeration machine and its adjustment), it was necessary to collect samples at various times of the year to determine the influence of soil temperatures on nematode populations. In the Tucson area of Arizona, these temperatures are sufficiently high to influence the depth at which the parasites are located.

Results:

A comparison of the numbers of nematodes obtained from aeration and auger plugs at different times of the year is given in the following table:

Mean Number of Nematodes Found/100 cc Soil Sample

Time of Sampling	Parasitic Nematodes		Non-Parasitic Nematodes	
	Aeration Plugs	Auger Plugs	Aeration Plugs	Auger Plugs
Oct.-March	30	17	48	59
April-May	53	65	102	77
June-Sept.	12	33	31	62

Discussion:

This study indicates that aeration plugs removed from golf greens can be successfully used for nematode analysis. The procedure should prove more satisfactory to greens superintendents and eliminate some of the usual problems in obtaining soil samples for study.

The decrease in plant parasitic nematode species from June to September indicates that temperatures in the Tucson, Arizona area are excessive in the upper three-inch soil level. The populations were reduced and some species were almost absent in some samples compared to the plugs removed by the soil auger method. Samples from April and May were considered ideal for obtaining the maximum numbers of nematodes from aeration plugs; this may, however, vary with the temperatures of a particular year.

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TURFGRASS MANAGEMENT UNDER SALINE CONDITIONS

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In late summer of 1962 six varieties of bermudagrass were established in one block at the Safford Experiment Station. These were Common, African, Tifway, Tifgreen, Tiffine, and B-181. Several phases of management and adaptability of these grasses under saline conditions were studied during 1964 and are herein reported.

Dormancy:

Five varieties started recovery from dormancy at about the same time, but they were two weeks later in doing so than was observed in 1963. In both 1963 and 1964, B-181 recovered 7 to 10 days sooner than did the other varieties.

Salinity:

During the entire 1964 season, only highly saline water (3200-3500 p.p.m. total soluble salts) was used to flood-irrigate these grasses. Although the soil moisture was purposely kept below optimum during much of the season, all varieties, with the exception of African, remained in fair to good condition.

Verticutting:

All plots were uniformly verticut (scalped), shortly after starting to green, and the thatch was removed. The Tifway thatch was quite thick. In descending order, the thickness of thatch was Tifway, Tifgreen, Tiffine, Common, B-181 and African. The African thatch was quite thin.

In mid-July and again in the first week of September, part of the Tifgreen area was further verticut to the soil surface. Recovery was rapid. With supplemental nitrogen and water, an acceptable lawn was reestablished within three weeks. During the remainder of September and up until dormancy started, much less browning and a more uniform appearance was observed in the spring- and summer-verticut Tifgreen than was noted in that which was verticut in the spring only.

Mowing Heights:

Each variety was divided into three equal subplots, with mowing heights as follows: 3/8", 1", and 2". These were cut with a 3-hp 21" Cooper reel-type mower. Clippings were caught and removed.

Although there was no apparent correlation between mowing height and the time required for a variety to completely green up, there were differences in the amount of thatch and in the general thickness of the turfgrass. The lowest height was always easily mowed, and all varieties, except African, had good color and density. In mid-August, all of the African had large, dormant areas. This browning was most pronounced in the lowest-cut sub-plot. Most of the browning had disappeared by late October.

As would be expected, the higher the mowing height, the denser the turfgrass. However, there were some noticeable differences between varieties. Common, Tiffine, B-181 and African never became so thick that they could not be clean-mowed. By mid-August, however, the 2" height Tifgreen was showing some light-colored areas where the mower had not cut clean. This was also observed in the 1" height Tifway. But the 2" cut Tifway was so thick by this time that it stopped the mower reel many times. A clean, even cut could not be made, and it had a ragged appearance for the rest of the year.

Fertilizers and Amendments:

On August 8, the following materials were broadcast, in separate strips within each variety, and watered in: ammonium sulfate (AS), zinc MNS, and ferrous ammonium sulfate (FAS). Each was applied at the rate of 10 pounds of material per 1000 sq. ft.

On August 17, the African and Tifgreen was noticeably greener, and the Tiffine and Tifway slightly greener, where FAS had been applied. There was no noticeable response to the other materials.

On August 28, the same response existed as on the 17th, but it was more pronounced. The shortest cut of the African was greening and recovering from summer dormancy faster than was evidenced in its higher cut portions.

Herbicides:

An area of the Tigreen lawn at the Station was heavily infested with annual grasses (primarily watergrass) and prostrate spurge. On August 28 various herbicides were applied to this area in replicated plots. Enough material was sprayed on each plot to uniformly wet the grass and weeds. The treatments were:

1. DSMA at the rate of 1 lb./10 gal. water.

2. MCPP at the rate of 2 1/4 oz./1000 sq. ft. (in 2 gallons of water).

3. DCPA at the rate of 15 lbs/acres + 1/2% spreader in 50 gallons of water.

Three days later annual grasses in the DSMA plots were browning. The Tifgreen yellowed and had a slightly scorched appearance, as did the spurge. Where MCPP was applied, the Tifgreen and the annual grasses were lightly scorched, but the spurge was wilted. No changes in grasses, spurge or Tifgreen due to DCPA was noted.

Fourteen days after application, annual grasses in DSMA plots definitely were dying. The Tifgreen had nearly recovered. MCPP had nearly killed the spurge and had yellowed, but not killed, the annual grasses. Tifgreen still had a slightly scorched and yellowed appearance. There were no apparent changes in grasses and spurge treated with DCPA.

After three weeks the Tifgreen was fully recovered in all plots. DSMA had killed the annual grasses, but not the spurge. MCPP had killed the spurge, but not the annual grasses. DSPA had no apparent affect on any weeds or on the Tifgreen, but it was noted later that no new weeds appeared in plots treated with this material.

Puncture vines in another area of Tifgreen were lightly sprayed with the MCPP solution on August 28. The next day these vines were dying. They were completely dead by September 7. The Tifgreen yellowed only slightly and was completely recovered 14 days after application.

Bermudagrass Mites:

Common bermudagrass which was in non-lawn areas and which was noted as isolated patches in the Tifgreen lawn was severely damaged by bermudagrass mites. There was little apparent injury to any grasses in the plots, including the common, or to the Tifgreen in the lawn.

Densitometer:

Evaluation of a "densitometer" for measuring the density of turfgrasses continued. A new unit, consisting of both a capacitance meter and a receptor (formerly termed "condensor") was obtained. A change of receptors is indicated, as the range in measured densities with the new unit is not satisfactory.